PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-221-M-1

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2010 Survey Report

Lake Tawakoni

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Tawakoni were surveyed in 2010 using electrofishing and in 2011 using gill netting, a littoral zone habitat survey, and an aquatic vegetation survey. An access-point creel survey was conducted from June 2008 through May 2009. This report summarizes the results of the surveys and contains a management plan for the reservoir.

- **Reservoir description:** Lake Tawakoni is located in Van Zandt, Rains, and Hunt Counties, Texas on South Fork and Cowleech Fork of the Sabine River and Caddo Creek. It was constructed by the Sabine River Authority to provide water for municipal and industrial uses and for recreational purposes. During the past 4 years lake elevations have decreased on two occasions for periods of approximately 12 consecutive months. In January 2009 the elevation reached its lowest level of that period at 4.9 feet below conservation pool elevation. Between November 2009 and April 2011, lake elevation decreased by 4.1 feet. The land-water interface was primarily natural shoreline (85.2%) and shoreline modifications consisted of piers and docks (14.0%), rocky shorelines (11.9%) and bulkheading (2.7%). The most abundant littoral habitat type was native emergent vegetation (60.4%) followed by flooded terrestrial vegetation (44.7%).

- **Management history:** Important sport fishes in Lake Tawakoni include striped bass, hybrid striped bass (palmetto bass and sunshine bass), white bass, blue catfish, channel catfish, and largemouth bass. Annual requests are submitted to stock striped bass and palmetto bass at a rate of 5/acre.

- **Fish community**
  - **Prey species:** Lake Tawakoni contained populations of both gizzard shad and threadfin shad of appropriate size to provide prey for sport fish. Sunfishes such as bluegill, redear sunfish, and longear sunfish added diversity to the prey fish populations.

  - **Catfishes:** Lake Tawakoni continued to support quality fisheries for blue and channel catfish. This species group accounted for 44.6% of directed angler effort. Blue catfish were by far the more abundant species although more channel catfish harvest was observed. Both species exhibit ample evidence of successful reproduction and body conditions were good.

  - **Temperate basses:** A diverse mixture of temperate bass species are supported by Lake Tawakoni's ample prey base and abundant open water habitat. Quality fisheries for white bass, striped bass, and hybrid striped bass co-exist in the lake and these combined fisheries contributed 35% of directed angler effort. Annual requests are made for stockings of striped bass and palmetto bass.

  - **Largemouth bass:** Largemouth bass populations have been historically stable but the lake's tendency to rapidly lose aquatic habitat with declining lake elevation often limits catches of bass in electrofishing. Largemouth bass anglers contributed 12% of directed angler effort. Florida largemouth bass were stocked in 2010 and 2011.

  - **Crappie:** White and black crappie were present in the reservoir, but they accounted for less than 3% of directed fishing effort.

- **Management strategies:** Annual requests for stockings of both striped bass and palmetto bass will continue at a rate of 5 fish per acre for each species. An optional gill netting survey will be conducted in Spring 2013, and general monitoring involving gill netting and electrofishing surveys will be repeated in 2014-2015. An aquatic vegetation survey will be conducted in 2014 and annual surveys will be performed to check for the presence of waterhyacinth.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Tawakoni from June 2010 through May 2011. Its purpose is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2010-2011 data for comparison.

Reservoir Description

Lake Tawakoni is an impoundment of the Sabine River in Van Zandt, Rains, and Hunt Counties, Texas. The reservoir was constructed by the Sabine River Authority (SRA) in 1960 as water supply for municipal, industrial, and recreational uses. At conservation pool (437.5 feet above mean sea level), Lake Tawakoni has a surface area of 36,700 surface acres, a shoreline length of 200 miles, and a mean depth of 12 feet. During the last four years, the difference in elevation between the maximum and minimum water levels was 6.5 feet, and annual fluctuations averaged between 3 and 4 feet (Figure 1). The reservoir was hypereutrophic with a mean trophic state index chl-*a* of 63.88 µg/L (Texas Commission on Environmental Quality 2008). The most abundant habitat type at the land-water interface at the time of sampling was natural shoreline with native emergent aquatic plants and flooded terrestrial species comprising the most common littoral habitat (Table 4). The abundance of aquatic vegetation in Lake Tawakoni was low (1.1% of reservoir surface area) with American lotus being the most abundant species (Table 5). Most of the land around the reservoir is used for timber production, agriculture, and residential development. Other descriptive characteristics for Lake Tawakoni are shown in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Jubar and Storey 2007) included:

1. Conduct angler access creel survey.
   Action: From June 2007 through May 2008 trailer counts were performed twice monthly at Lake Tawakoni's public and private boat ramps to calculate probabilities for angler use of each ramp. An angler access creel survey was conducted between June 2008 and May 2009.
2. Continue requests for annual stockings of striped bass and palmetto bass.
   Action: Annual requests for stockings of striped bass and palmetto bass at a rate of 5 fish/acre were submitted. Directed angler effort for temperate basses between June 2008 and May 2009 accounted for 35% of total effort.
3. Challenges of sampling largemouth bass as a result of low water levels and limited habitat.
   Action: Fall electrofishing sampling was conducted every two years. A sample of young-of-year largemouth bass was collected in fall 2008 for genetic assessment. An age sample was also collected in fall 2008. Optional spring elecrofishing surveys were not conducted.
4. Increase access facilities for bank anglers at Lake Tawakoni.
   Action: The Sabine River Authority has not revived the project to build a public fishing pier on Lake Tawakoni but the City of West Tawakoni built a new boat ramp with a floating pier and a pavilion in 2010.
5. Increase awareness of fisheries resources at Lake Tawakoni
   Action: District staff prepared laminated posters regarding giant salvinia which were distributed to staff at Lake Tawakoni State Park. Periodic requests are made by outdoor writers regarding the status of fisheries resources in Lake Tawakoni.

Harvest regulation history: Sport fishes in Lake Tawakoni are currently managed with TPWD statewide regulations (Table 2).

Stocking history: Requests for striped bass and palmetto bass stockings at a rate of 5/acre are submitted annually. In most years, stockings are accomplished unless production is limited. Palmetto bass have

been stocked in 14 of the last 17 years, and striped bass have been stocked on 15 occasions during the same time period (Table 3). The Lake Tawakoni Sportsman's Association (LTSA) purchased 139,000 sunshine bass (male striped bass x female white bass hybrids) in 2004, 60,900 in 2007, and 50,440 in 2011 after receiving stocking permits from TPWD. Florida largemouth bass were stocked in 2010 and 2011. The complete stocking history is listed in Table 3.

Vegetation/habitat history: Historically, aquatic vegetation coverage at Lake Tawakoni consisted of small amounts of native emergent vegetation and limited submerged species. The dominant species were American lotus and waterwillow. Aquatic vegetation observed in 2010 represented 1.1% of the reservoir surface area. In 2004, a waterhyacinth infestation, originating in Ash Cove, was reported to District 3B staff. A vegetation survey was conducted in December of that year to assess the extent of its coverage. Waterhyacinth plants observed were primarily small floating colonies and coverage was estimated at 1.5 acres. Declining water levels limited the spread of the plants. Staff of the Sabine River Authority (SRA) treated plants in Ash Cove that were stranded on the shoreline. No plants were observed during a follow-up survey conducted in August 2007, but an estimated 5 acres of waterhyacinth was documented in July 2008. The infestation was successfully treated by Texas Parks and Wildlife Department's Aquatic Habitat Enhancement staff. In August 2009 a small quantity of waterhyacinth plants in Ash Cove were physically removed by District 3B personnel during a vegetation survey. District staff will continue to monitor this threat as shorelines are inundated and the conditions become favorable for the germination of any seeds that are buried in the sediment.

Water Transfer: Lake Tawakoni is primarily used for municipal water supply, recreation, and to a lesser extent, flood control. There are currently 15 entities which transfer water from the reservoir to other locations. These include Cash SUD, Combined Consumers, Lone Oak Land Development, MacBee, North Texas Municipal Water District, Nortex Nursery, South Tawakoni WSC, and the following cities: Dallas, Commerce, Edgewood, Emory, Greenville, Point, West Tawakoni, and Wills Point.

METHODS

Fishes were collected by electrofishing (2.0 hours at 24, 5-min stations) and gill netting (15 net nights at 15 stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and for gill nets as the number of fish caught per net night (fish/nn). All survey sites were randomly selected, and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009). An access-point angler creel survey consisting of 9 survey days per quarter (4 weekdays, 5 weekend days) was conducted from June 2008 through May 2009 to estimate angler catch and harvest rates and angling effort in accordance with Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009). Aquatic vegetation, littoral habitat, and angler access surveys were performed according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009).

Sixty-one anglers were interviewed regarding their preferences about catfish angling on Lake Tawakoni from September 2008 through May 2009. The four questions posed are presented in Appendix D. Only those anglers who fished for catfish were interviewed.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), as defined by Guy et al. (2007)], and condition indices [Relative Weights (*Wr*)] were calculated for target fishes according to Anderson and Neumann (1996). Index of Vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics, and SE was calculated for structural indices and IOV. Ages were determined using otoliths from largemouth bass (N=13, length range 13.0 to 14.7 inches), blue catfish (N=11, length range 11.3 to 12.9 inches), and channel catfish (N=8, length range 11.3 to 12.9 inches) using fish from one inch class below to one inch class above the legal length limit. A sample of 30 age-0 largemouth bass were collected by electrofishing in fall 2008 and subjected to genetic analysis using DNA microsatellite analysis in accordance with Fishery Assessment Procedures (TPWD, Inland Fisheries

Division, unpublished manual revised 2009). Water elevation data were obtained from the Sabine River Authority (SRA) website at http://www.sra.dst.tx.us/basin/lake_tawakoni_monthly.asp.

RESULTS AND DISCUSSION

Habitat: The most abundant habitat type at the land-water interface was natural shoreline (85.2%). Modifications at this interface included piers and docks (14.0%), rocky shoreline (11.9%), and bulkhead (6.2%). Native emergent aquatic vegetation (60.4%) and flooded terrestrial vegetation (44.7%) were the most common littoral habitat types observed in summer 2010 (Table 4). Aquatic vegetation in Lake Tawakoni is generally limited. Previous vegetation surveys observed no aquatic vegetation in 2006 and 189 acres (0.5%) in 2002. In 2010, aquatic vegetation coverage (418.4 acres) represented 1.1% of the reservoir surface area and was dominated by American lotus, waterwillow, and smartweed (Table 5). A trace amount of hydrilla was observed but no waterhyacinth was documented.

Creel: Directed rod-and-reel angler effort for catfish (blue, channel, and flathead catfish combined) from June 2008 to May 2009 was highest, accounting for 44.6% of total angler effort (Table 6). The fishery for temperate basses (striped bass, hybrid striped bass, and white bass) was second in importance, representing 35% of angler effort. Directed angler effort for largemouth bass accounted for 12.1% of the total, and crappie angling effort contributed a further 2.6%. Total fishing effort was estimated at 162,641 hours, and directed expenditures totaled $1,433,605 (Table 7).

Prey species: Primary prey fish populations included gizzard shad, threadfin shad, and bluegill. Gizzard shad were the most abundant prey fish species collected in 2010. Electrofishing catch rates in 2002 (209.5/h), 2006 (243.0/h), and 2010 (187.0/h) were all comparatively high (Figure 2). Gizzard shad were readily available as prey as evidenced by consistently high (86-94) index of vulnerability (IOV) values. Total CPUE of threadfin shad was 82.0/h (Appendix A). Bluegill catch rate in 2010 (74.5/h) was higher than in 2006 (10.0/h) but lower than in 2002 (107.5/h) (Figure 3). Redear sunfish were also available as prey, but they were much less abundant than bluegill. Redear sunfish electrofishing CPUE in 2010 was 27.0/h (Figure 4).

Catfishes: Lake Tawakoni's catfish populations continue to be dominated by blue catfish. Gill net catch rate of blue catfish in 2011 (14.9/nn) was higher than in previous surveys in 2009 (11.3/nn) and 2007 (13.6/nn) (Figure 5). Recruitment was high, and numerous individuals less than stock size (<11 inches) were sampled. Legally-harvestable fish (≥12 inches) represented 67% of all fish collected. Fish body condition was good with most inch groups having relative weights ranging from 80 - 95. Growth rate of blue catfish in Lake Tawakoni was good; average age of 12-inch fish (mean = 12.1 inches; range = 11.3 - 12.9 inches,) was 2.5 years (N = 11; range = 2 – 3 years).

Channel catfish were also present in the reservoir but they were considerably less abundant than blue catfish. Catch rate of channel catfish in 2011 (5.5/nn) was higher than in 2009 (4.9/nn) and in 2007 (4.3/nn) (Figure 6). Although harvestable-size channel catfish accounted for only 27% of the fish collected in gill nets, rod-and-reel harvest of channel catfish (Figure 8) was over twice that observed for blue catfish (Figure 7). This would indicate that directed rod-and-reel effort for blue catfish is low. Channel catfish growth rate was also good; average age of 12-inch fish (mean=12.1 inches, range=11.3 - 12.9 inches) was 3.1 years (N = 8; range = 2 – 4 years).

Directed rod-and-reel effort for catfish from June 2008 to May 2009 was estimated at 72,532 h, angler catch rate was 1.2/h, and harvest rate was 1.0/h (Table 8). The majority of catfish caught on Lake Tawakoni are legal-sized, and the majority of those are harvested; less than 8% of legal sized fish are released. During the winter quarter of the creel survey, a limited jugline fishery for trophy blue catfish was observed. However, catch information from passive-gear anglers was not collected. Anglers who fished for catfish were overwhelmingly satisfied with the catfish regulations at Lake Tawakoni (Appendix D). They expressed mixed preferences when asked to choose between larger numbers of legal-sized fish or fewer

trophy sized fish in determining the success of a fishing trip. If anglers caught larger catfish, most indicated they would release them. The majority of rod-and-reel catfish anglers believed protecting trophy- sized catfish would improve the fishery. Two passive gear catfish anglers interviewed did not agree, and catfish anglers who were targeting alternative species were mixed in their opinions. (Appendix D).

Temperate basses: The gill net catches of white bass in 2011 (1.9/nn) and 2009 (1.5/nn) were lower than in 2007 (4.0/nn) (Figure 9) and also markedly lower than in 2003 (6.9/nn) and 2005 (9.6/nn) (Jubar and Storey 2007). Angler harvest of white bass from June 2008 through May 2009 was highest of all temperate basses (Figure 12). One striped bass was collected in gill net sampling in 2011, the lowest level observed in the current review (Figure 10). The previous management review (Jubar and Storey 2007) reported catch rates of 2.3/nn (2003) and 1.1/nn (2005). Harvest of striped bass in the creel survey was low (Figure 13). Gill net catch rate of hybrid striped bass (palmetto bass and sunshine bass combined) in 2011 (0.9/nn) was similar to that in 2007 (1.1/nn) but lower than in 2009 (4.0/nn) (Figure 11). Anglers' difficulty in distinguishing between hybrid striped bass and white bass likely resulted in illegal harvest of 8% of hybrid striped bass retained by anglers (Figure 14). Anecdotal information from local anglers and guides indicated temperate bass fishing in spring 2011 has been some of the best on record, despite low observed catches in gill nets. Insufficient numbers of white bass, striped bass, and hybrid striped bass were collected in gill nets for age and growth analyses. Directed effort for temperate basses from June 2008 through May 2009 was estimated at 56,863 hours, angler catch rate was 1.14/h, and harvest rate was 0.45/h (Table 9).

Largemouth bass: Electrofishing sampling on Lake Tawakoni is often less efficient as a result of loss of shallow aquatic habitat when lake elevation is reduced at time of sampling. In 2010 largemouth bass CPUE was 37.0/h, lower than in 2008 (48.0/h) but higher than in 2006 (4.0/h) (Figure 15). The 2010 sample was dominated by fish shorter than the legal minimum length with less than 3% of fish $\geq$14 inches. Average age at 14 inches (mean=13.7 inches, range=13.0–14.7 inches) was 1.0 years (N=13; range=1 year). Few largemouth bass were retained during creel surveys, and 67% of those observed were involved in live-release tournaments (Figure 16). Largemouth bass were the third most important game fish in terms of directed fishing effort, contributing 12% of total fishing effort. Angler catch rate was 0.32/h and harvest was negligible (0.01/h) (Table 10). Following the submission of a request to stock Florida largemouth bass at a rate of 25/acre, (based on improved aquatic habitat subsequent to water level increase), 508,133 fingerlings were stocked in 2010 and 501,454 in 2011. Genetic analysis performed in 2008 indicated an FLMB allele frequency of 20.0%. No pure FLMB were detected in the sample (Table 11). No genetic analysis was performed in 2010 to avoid potential for sampling age-0 stocked fish.

Crappies: Crappie accounted for a directed angler effort of 4,246 h (Table 12) which represented less than 3% of total effort. Angler catch rate was 1.93/h and harvest rate was 1.80/h indicating the majority of fish caught were of legal size and were subsequently harvested. The majority of crappie harvested were black crappie (Figure 18) although a small number of white crappie were also encountered (Figure 17).

Fisheries management plan for Lake Tawakoni, Texas

Prepared – July 2011

ISSUE 1: Catfish are Lake Tawakoni's most targeted fisheries resource. In 2001, the State Legislature designated Lake Tawakoni as the Catfish Capital of Texas. From June 2008 through May 2009 catfish rod-and-reel angling accounted for 44.6% of total directed effort (75,532 hrs). Continue efforts to monitor this fisheries resource.

MANAGEMENT STRATEGIES

1. Conduct supplemental gill netting in spring 2013.
2. Conduct access point creel survey from June 2014 through May 2015 to monitor angler effort, catch and harvest of catfish species.

ISSUE 2: Lake Tawakoni has a high number of temperate bass species which provide excellent fisheries resources. Striped bass, hybrid striped bass (palmetto bass and sunshine bass) and white bass all combine to make an important fishery in Lake Tawakoni. From June 2008 through 2009 rod-and-reel anglers seeking temperate basses accounted for 35.0% of total directed effort (56,863 hrs).

MANAGEMENT STRATEGIES

1. Continue submitting annual request for stocking of striped bass and palmetto bass each at a rate of 5 fish/acre.
2. Encourage efforts by the Lake Tawakoni Sportsman's Association's efforts to purchase sunshine bass to supplement TPWD's efforts. Assist with their stocking.
3. Conduct supplemental gill netting in spring 2013.
4. Conduct access point creel survey from June 2014 through May 2015 to monitor angler effort, catch and harvest of temperate bass species.

ISSUE 3: Electrofishing catch rates of largemouth bass have declined in recent years. Directed effort for largemouth bass (19,731) accounted for 12.1% of total directed effort from June 2008 through May 2009. Periods of low water levels and reduced habitat are most likely the cause. Increasing demands for water by the large number of entities that currently pump from Lake Tawakoni will likely make reduced water elevations more common. Continue efforts to monitor and enhance Lake Tawakoni's largemouth bass fishery.

MANAGEMENT STRATEGIES

1. Discontinue supplemental electrofishing sampling every 2 years. Conduct fall electrofishing survey in 2014.
2. Collect a 30-fish sample of largemouth bass in fall 2014 for genetic analysis.

ISSUE 4: Increased awareness of Lake Tawakoni fisheries resources is desirable. Dissemination of information describing the sport fish harvest regulations in effect on Lake Tawakoni is also needed.

MANAGEMENT STRATEGIES

1. Prepare regulation posters detailing fisheries regulations in effect at Lake Tawakoni and post this information at public and private boat ramps, in Lake Tawakoni State Park, and in local businesses.
2. Produce news releases promoting the fisheries resources of Lake Tawakoni for distribution to local media outlets.

ISSUE 5: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any

available hard structure, restricting water flow in pipes, fouling swimming beaches, and plugging engine cooling systems. Giant Salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing, and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with posters, literature, etc. so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the Internet.
4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes mandatory monitoring in 2014-2015 (Table 6). Gill net surveys will be conducted every two years to monitor the catfish, and temperate bass populations. Annual vegetation surveys will be conducted to monitor the status of waterhyacinth in Lake Tawakoni.

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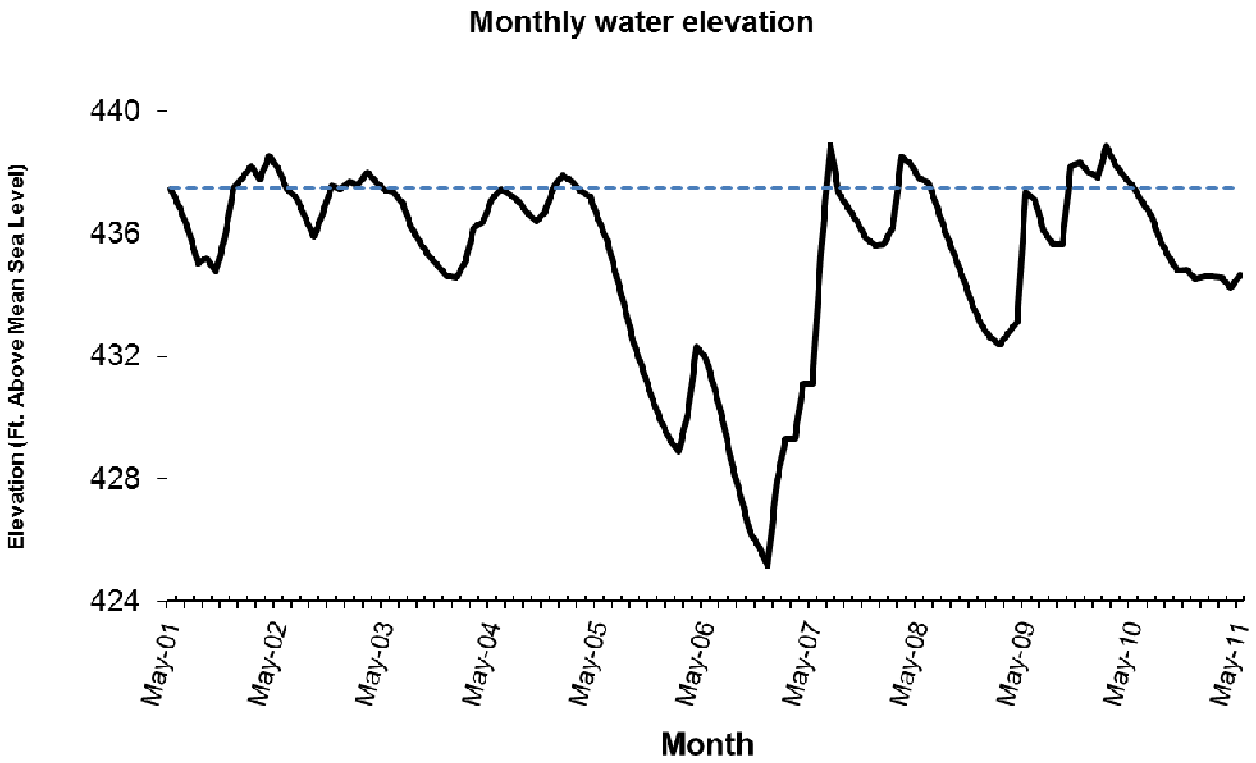


Figure 1. Monthly water level elevations in feet above mean sea level (MSL) recorded for Lake Tawakoni from May 2001 – May 2011. Conservation pool elevation for Lake Tawakoni is 437.5 ft msl.

Table 1. Characteristics of Lake Tawakoni.

Characteristic	Description
Year constructed	1960
Controlling authority	Sabine River Authority
Counties	Van Zandt & Rains (location of dam), Hunt
Reservoir type	Mainstream
Shoreline development index (SDI)	7.45
Conductivity	175 umhos/cm

Table 2. Harvest regulations for Lake Tawakoni, Texas.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish, channel and blue catfish	25 (in any combination)	12 - No Limit
Catfish, flathead	5	18 - No Limit
Bass, white	25	10 – No Limit
Bass, striped and hybrid striped bass	5 (in any combination)	18 – No Limit
Bass, largemouth	5	14 - No Limit
Crappie, white and black crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

Table 3. Stocking history of Lake Tawakoni. Size Categories are: FRY =<1 inch; FGL = 1-3 inches; AFGL = 8 inches; and ADL = adults.

Year	Number	Size
	Blue catfish	
1989	366,675	
Total	366,675	
	Striped bass	
1979	755,800	
1982	195,694	
1991	352,558	FGL
1992	203,462	FGL
1993	184,300	FGL
1994	722,640	FGL
1995	382,333	FGL
1996	183,700	FGL
1997	257,080	FGL
1998	135,256	FGL
1999	262,678	FGL
2000	189,410	FGL
2002	288,856	FGL
2003	369,005	FGL
2004	78,739	FGL
2005	100,211	FGL
2006	156,865	FGL
2007	916,724	FRY
2007	320,619	FGL
2008	283,198	FGL
2009	1,719,115	FRY
2009	348,921	FGL
2010	8,000	FRY
2010	150,970	
Total	8,566,134	

Year	Number	Size
	Palmetto bass	
1975	100,466	FGL
1979	181,500	FGL
1980	110,400	FGL
1983	179,302	FGL
1995	218,946	FGL
1996	166,295	FGL
1997	119,000	FGL
1998	267,842	FGL
1999	128,619	FGL
2002	92,910	FGL
2004	189,319	FGL
2005	189,557	FGL
2006	188,206	FGL
2007	172,704	FGL
2008	190,027	FGL
2009	97,968	FGL
2010	182,650	FGL
2011	152,443	FGL
Total	2,928,154	
	Sunshine bass	
2004	139,000	FGL
2007	60,900	FGL
2011	50,440	FGL
Total	250,340	

Year	Number	Size
	Florida largemouth bass	
1984	507,714	FGL
1992	469,904	FGL
1993	917,785	FGL
1998	367,500	FGL
1999	364,995	FGL
2010	508,133	FGL
2011	501,454	FGL
Total	3,637,485	
	Green x Redear sunfish	
1973	5,300	FGL
Total	5,300	
	Walleye	
1979	450,000	FGL
Total	450,000	

Table 4. Survey of physical habitat types, Lake Tawakoni, Texas, August 2010. A linear shoreline distance (miles) was recorded for each habitat type found. Total shoreline distance is 228.0 miles. The sum of shoreline distances exceeds the lake perimeter because of overlap of habitat types.

Land-Water interface descrition	Littoral and Pelagic habitat descripiton	Shoreline distance	
		Miles	Percent of total
Natural shoreline		194.34	85.2%
Piers & docks		31.84	14.0%
Rocky shoreline		27.13	11.9%
Bulkhead		14.13	6.2%
	Native emergent	137.84	60.4%
	Flooded terrestrial	101.86	44.7%
	Standing timber	42.37	18.6%
	Native floating	6.39	2.8%
	Native submerged	0.78	0.3%
	Hydrilla	0.05	<0.1%

Table 5. Vegetation survey, Lake Tawakoni, Texas, August 2010.

Aquatic vegetation species	Surface Area	
	Acres	Percent of reservoir surface area
American lotus *(Nelumbo lutea)*	312.0	
American lotus / smartweed *(Polygonum sp.)*	0.4	
Cattails (*Typha sp.*)	2.5	
Phragmites sp.	0.4	
Pondweed *(Potomageton sp.)*	0.6	
Smartweed	33.0	
Waterwillow *(Justicia sp.)*	55.7	
Waterwillow / cattail	0.4	
Waterwillow / smartweed	13.4	
Hydrilla *(Hydrilla verticillata)*	<0.1	
Total	418.4	1.1

Table 6. Percent directed angler effort by species for Lake Tawakoni, Texas, June 2008 through May 2009.

Species or Species Group	Percent
Catfish spp.	44.6
Temperate basses	35.0
Black bass	12.1
Crappie spp.	2.6
Anything	5.7

Table 7. Total fishing effort (h) for all species and total directed expenditures at Lake Tawakoni, Texas, June 2008 through May 2009.

Creel Statistic	
Total fishing effort (hours)	162,641
Total directed expenditures	$1,433,605

Gizzard shad

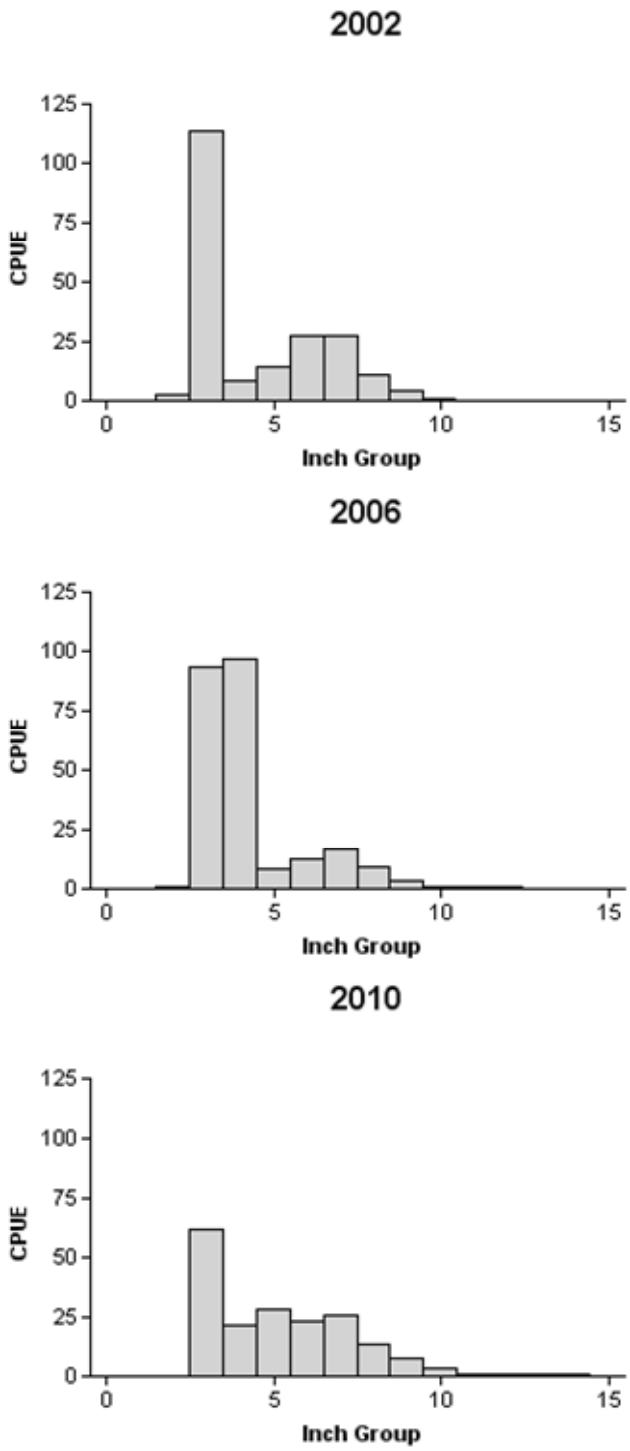
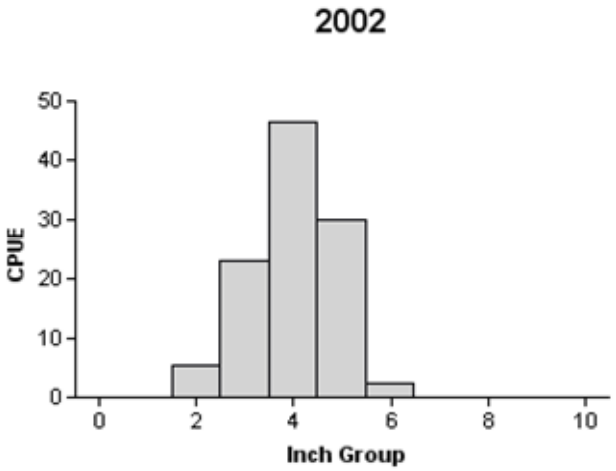
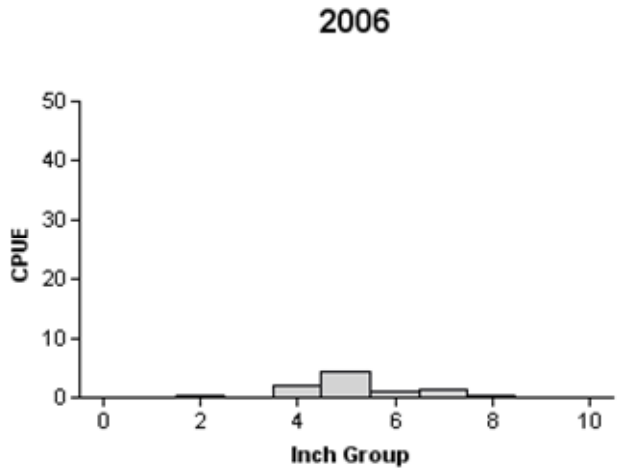


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure and IOV are in parentheses) for fall electrofishing surveys, Lake Tawakoni, Texas, 2002, 2006, and 2010.

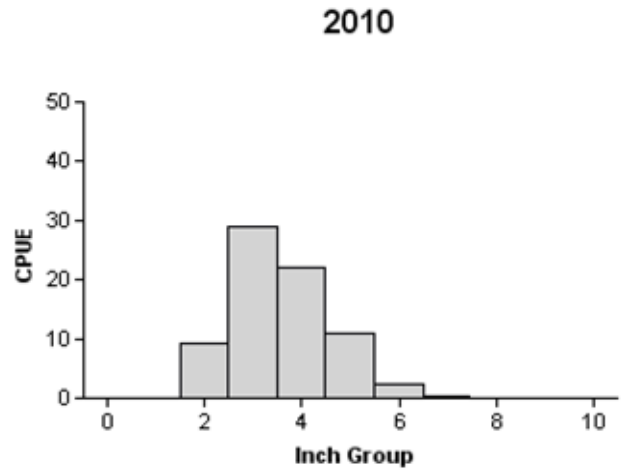
Bluegill



Effort = 2.0
Total CPUE = 107.5 (31; 215)
PSD = 2 (1.3)



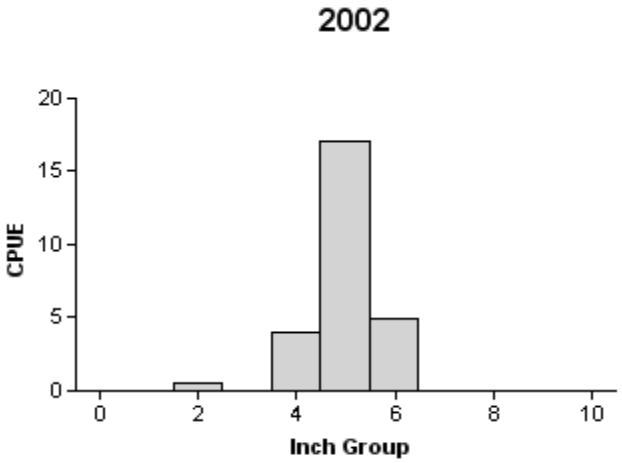
Effort = 2.0
Total CPUE = 10.0 (33; 20)
PSD = 32 (14.9)



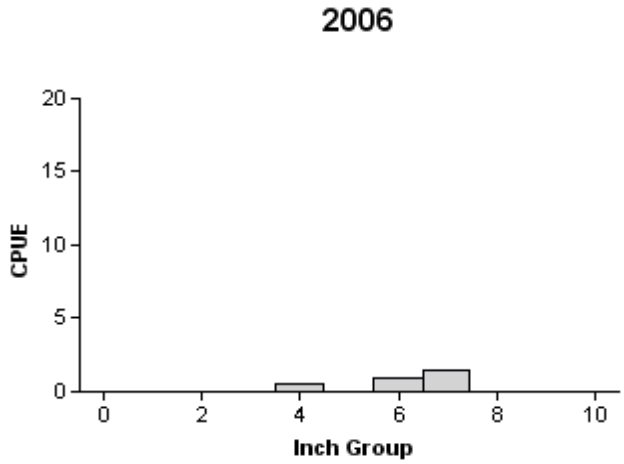
Effort = 2.0
Total CPUE = 74.5 (26; 149)
PSD = 5 (1.7)

Figure 3. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tawakoni, Texas, 2002, 2006, and 2010.

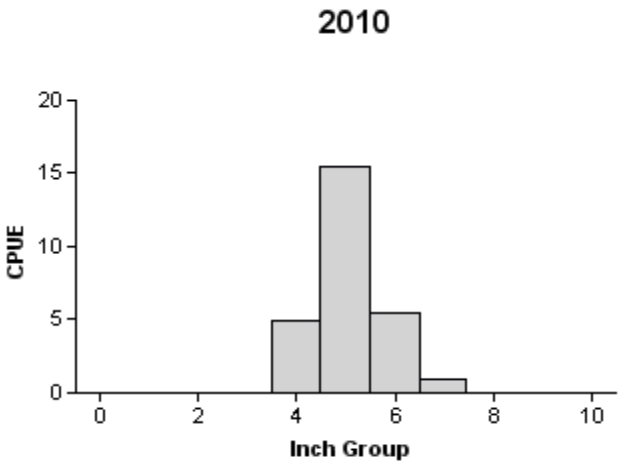
Redear sunfish



Effort = 2.0
Total CPUE = 26.5 (28; 53)
PSD = 0 (35.4)



Effort = 2.0
Total CPUE = 3.0 (43; 6)
PSD = 50 (17)



Effort = 2.0
Total CPUE = 27.0 (33; 54)
PSD = 4 (2.3)

Figure 4. Number of redear sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tawakoni, Texas, 2002, 2006, and 2010.

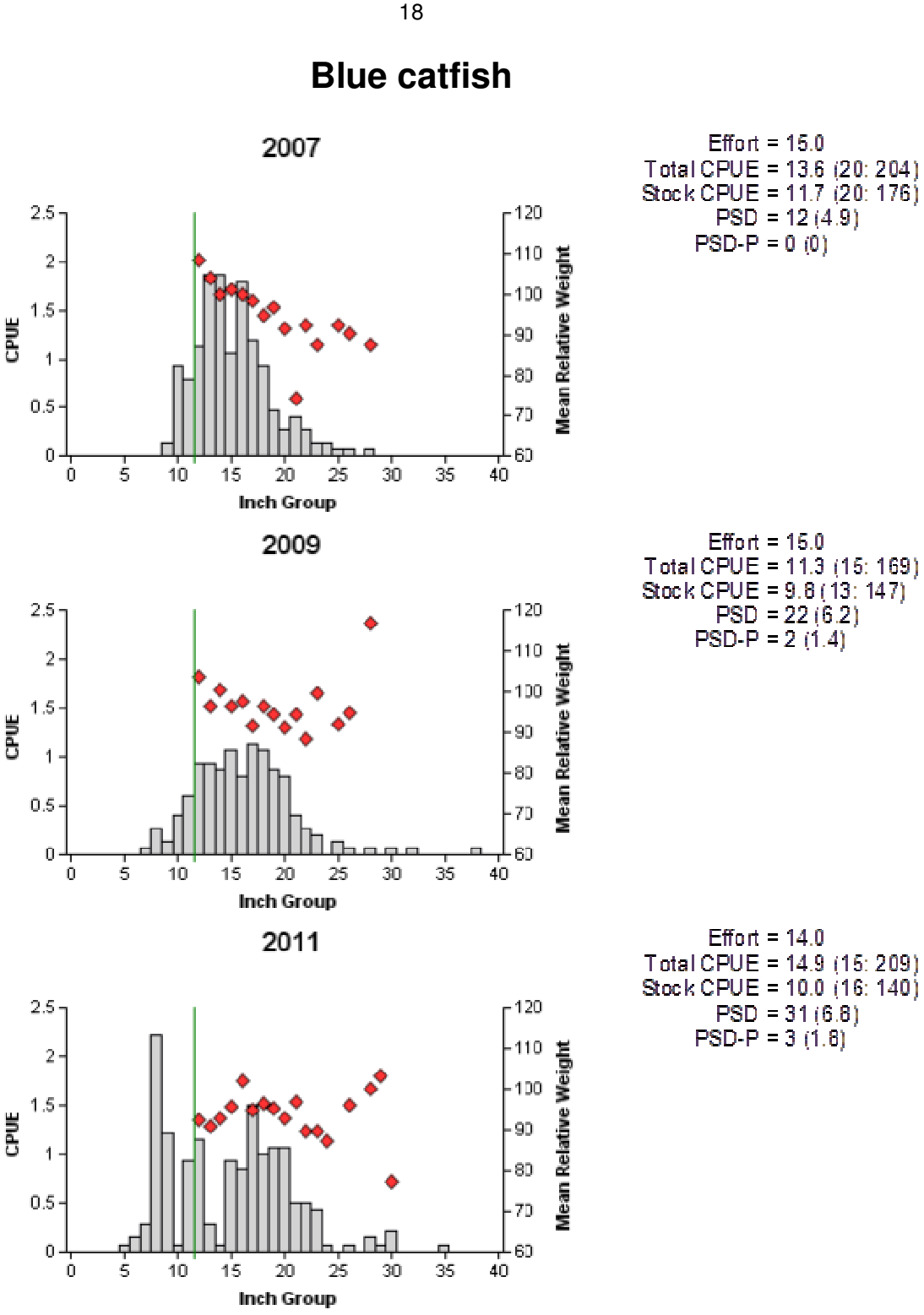


Figure 5. Number of blue catfish caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Tawakoni, Texas, 2007, 2009, and 2011. Vertical lines represent minimum length limit at time of survey.

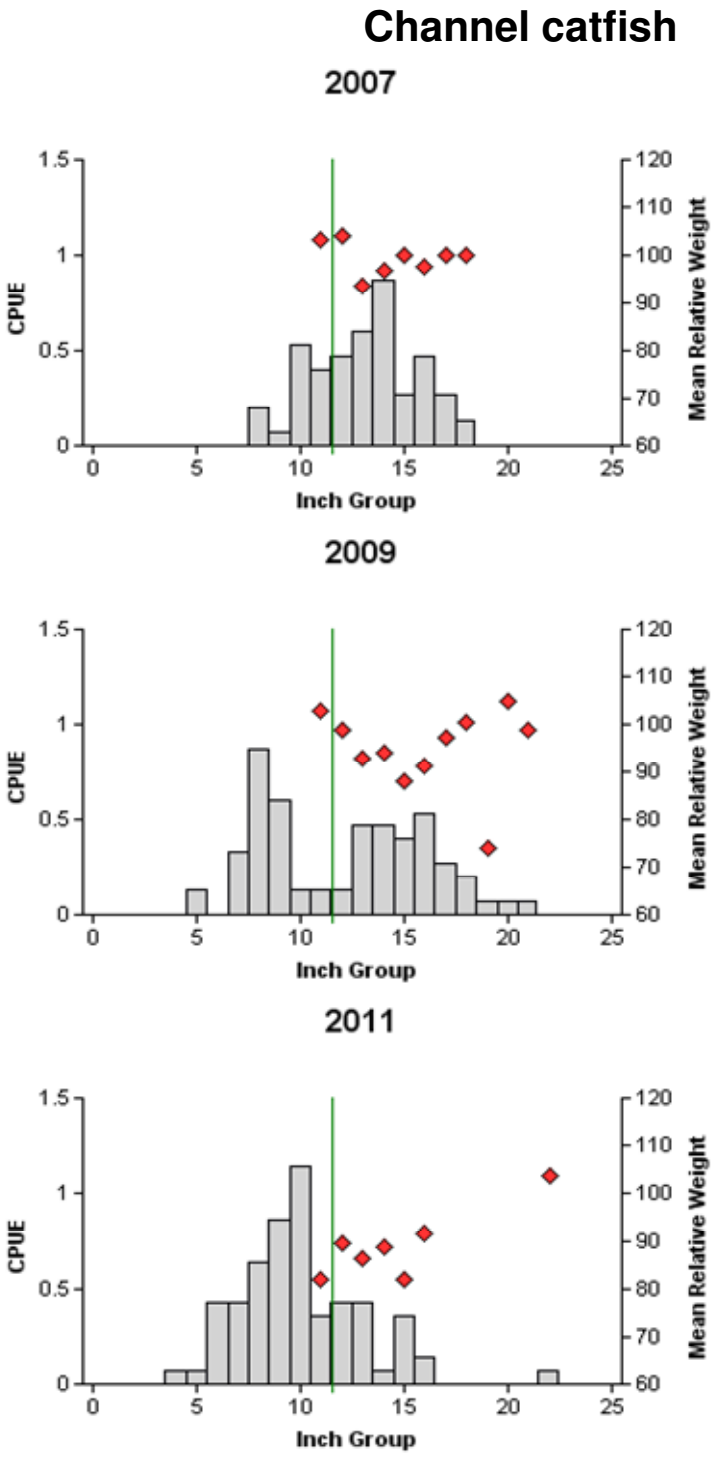


Figure 6. Number of channel catfish caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Tawakoni, Texas, 2007, 2009, and 2011. Vertical lines represent minimum length limit at time of survey.

Table 8. Creel survey statistics for rod-and-reel catfish (channel, blue, and flathead catfish combined) anglers at Lake Tawakoni from June 2008 through May 2009 where total catch per hour is for anglers targeting catfish and total harvest is the estimated number of catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2008-2009
Directed effort (h)	72,532 (19)
Directed effort/acre	1.98 (19)
Total catch per hour	1.20 (40)
Catch/acre	3.60 (36)
Harvest per hour	1.00 (46)
Harvest/acre	3.13 (40)
Total harvest	114,939 (40)
Percent legal released	7.9

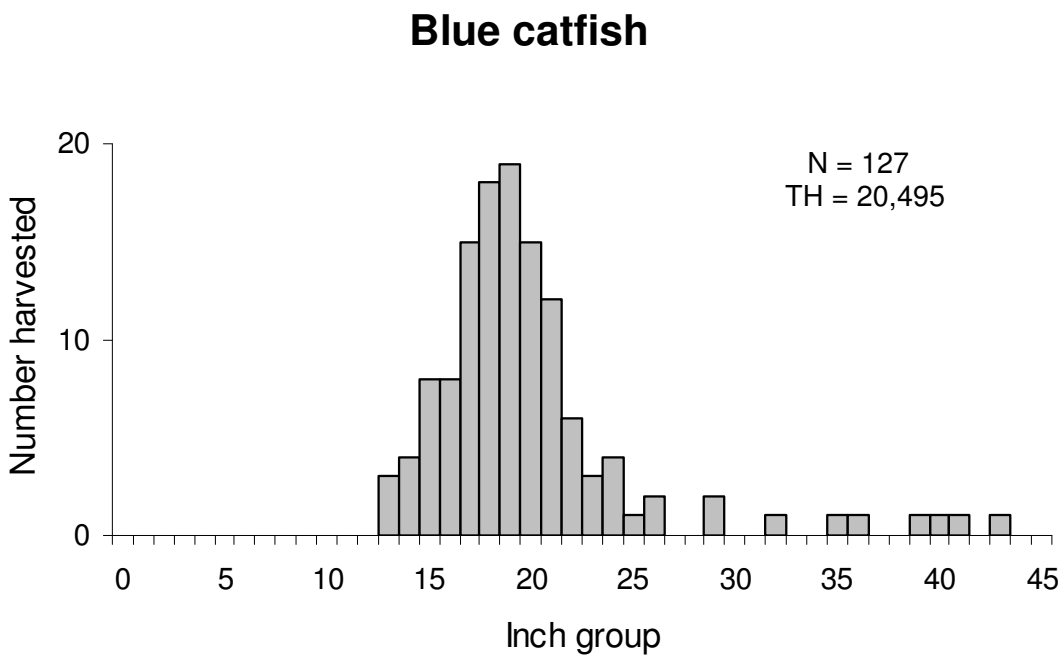


Figure 7. Length frequency of harvested blue catfish observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested blue catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

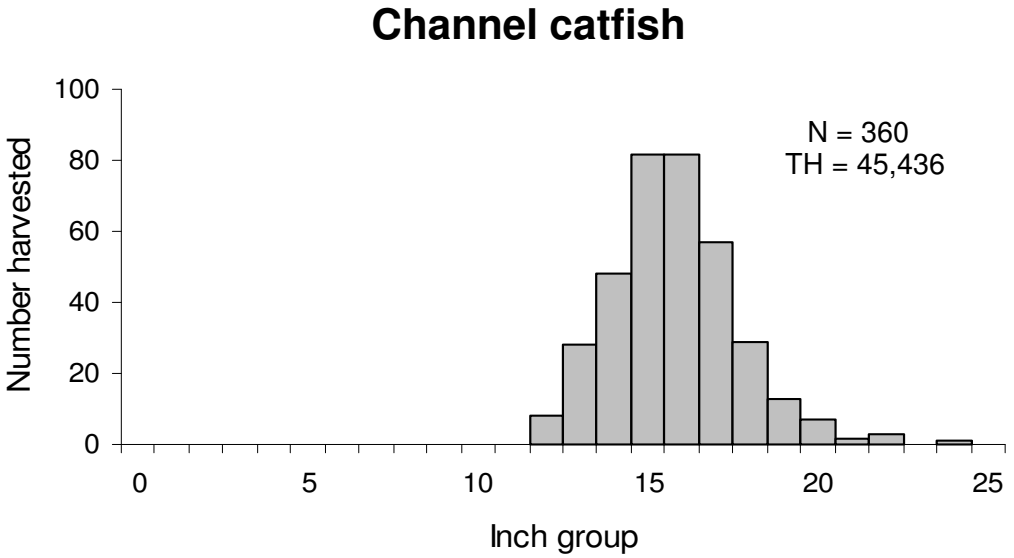


Figure 8. Length frequency of harvested channel catfish observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested channel catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

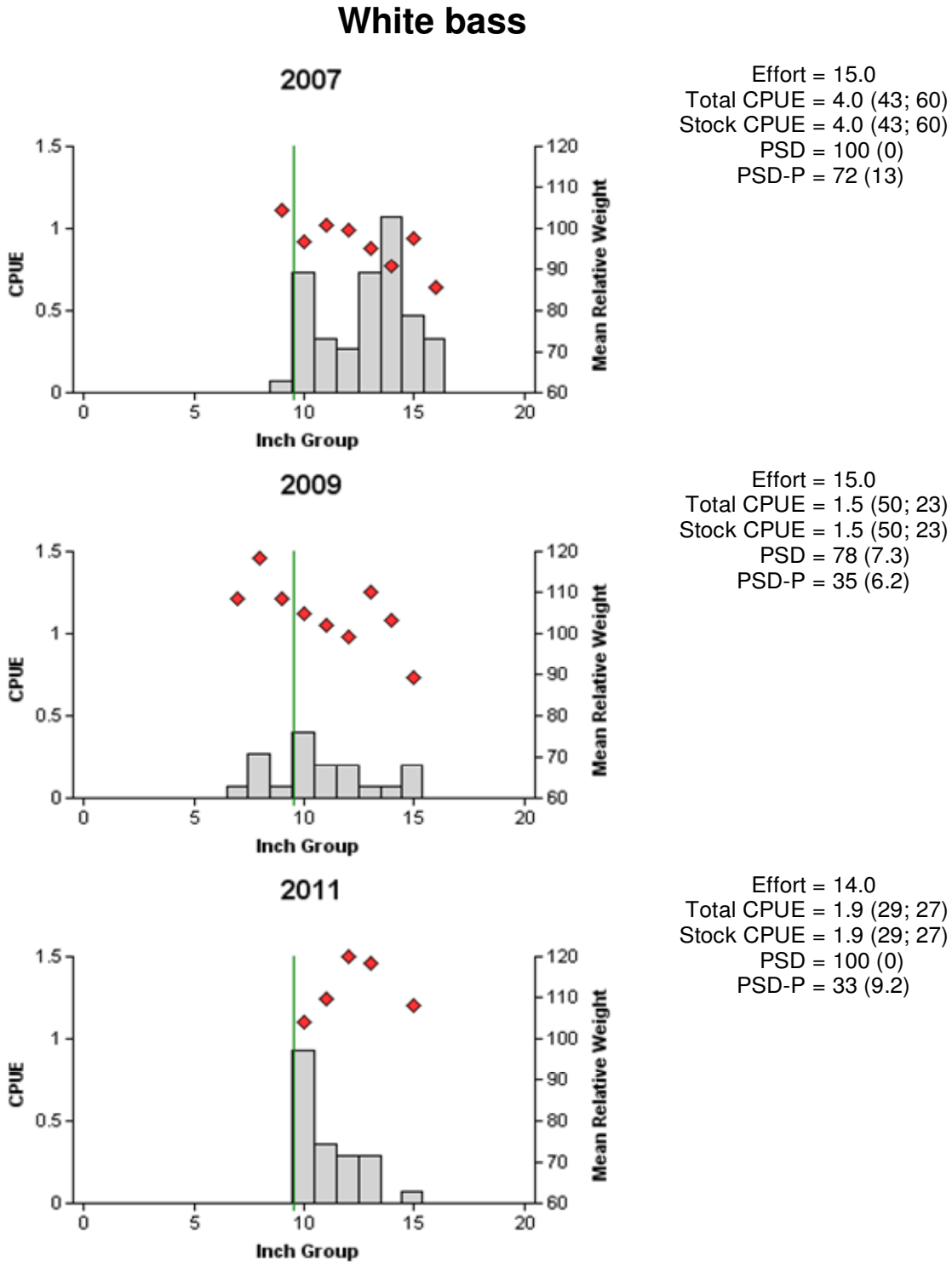
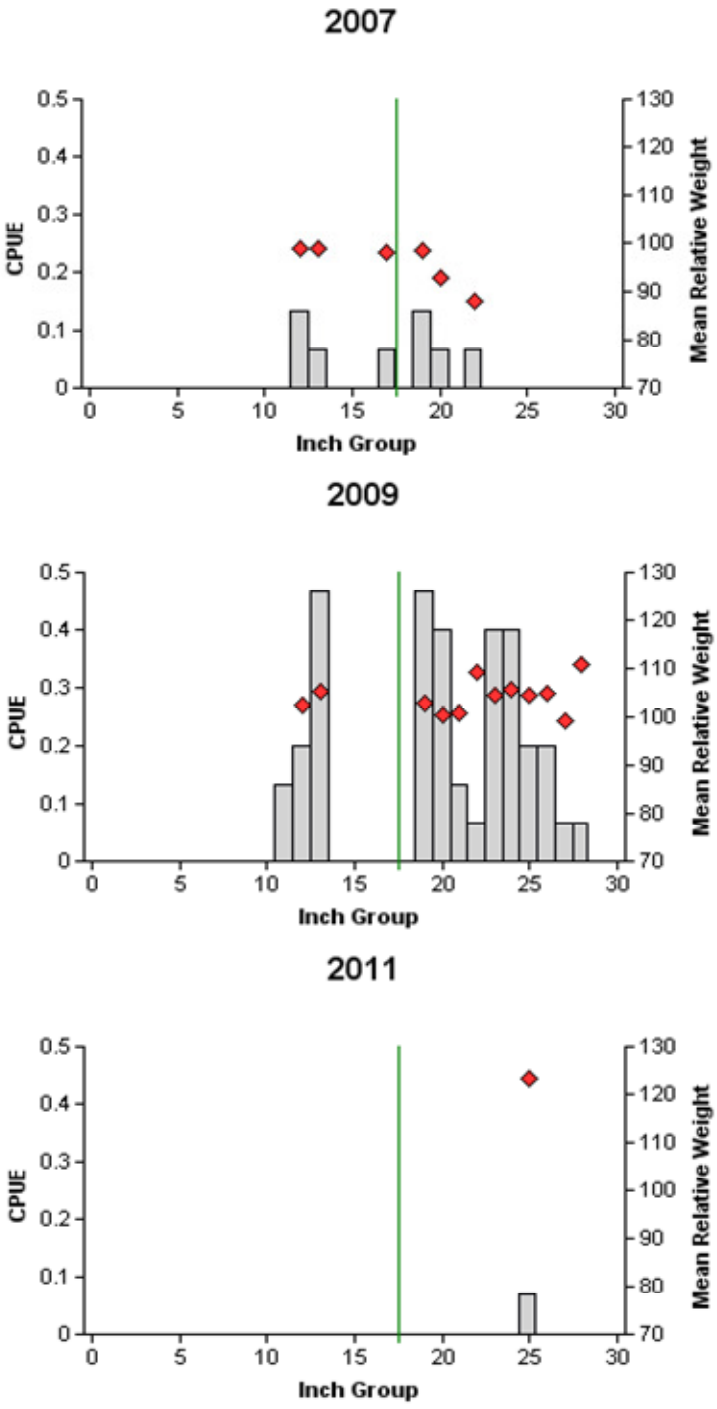


Figure 9. Number of white bass caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Tawakoni, Texas, 2007, 2009, and 2011. Vertical lines represent minimum length limit at time of survey.

Striped bass



Effort = 15.0
Total CPUE = 0.5 (57; 8)
Stock CPUE = 0.5 (57; 8)
PSD = 25 (9.2)
PSD-P = 100 (0)

Effort = 15.0
Total CPUE = 3.2 (39; 48)
Stock CPUE = 3.1 (39; 46)
PSD = 63 (10.2)
PSD-P = 100 (0)

Effort = 14.0
Total CPUE = 0.1 (100; 1)
Stock CPUE = 0.1 (100; 1)
PSD = 100 (0)
PSD-P = 100 (0)

Figure 10. Number of striped bass caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Tawakoni, Texas, 2007, 2009, and 2011. Vertical lines represent minimum length limit at time of survey.

Hybrid striped bass

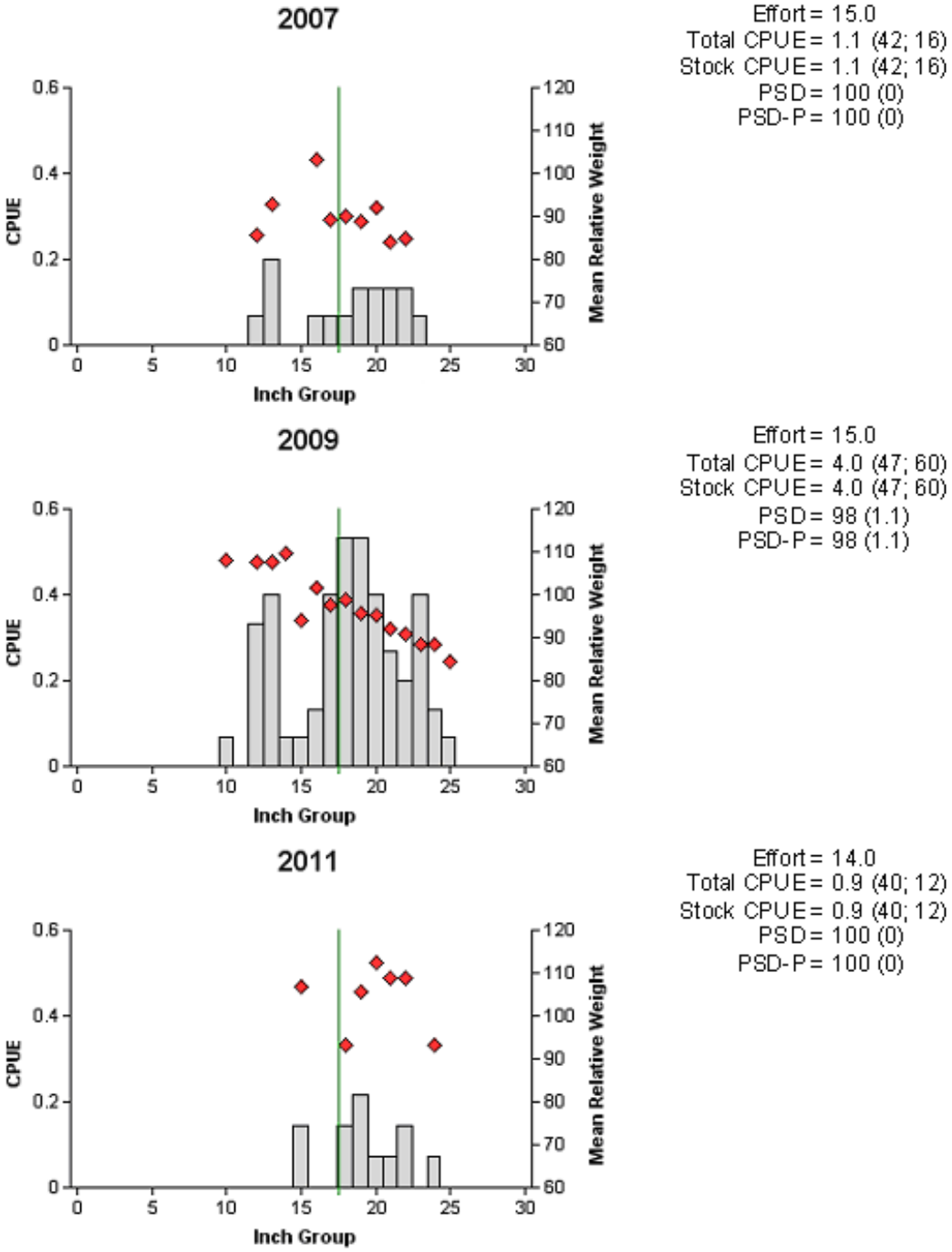


Figure 11. Number of hybrid striped bass (palmetto bass and sunshine bass) caught per net night (CPUE), mean relative weights (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Tawakoni, Texas, 2007, 2009, and 2011. Vertical lines represent minimum length limit at time of survey.

Table 9. Creel survey statistics for rod-and-reel temperate bass (white bass, striped bass, and hybrid striped bass combined) anglers at Lake Tawakoni from June 2008 through May 2009 where total catch per hour is for anglers targeting temperate basses and total harvest is the estimated number of temperate basses harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2008-2009
Directed effort (h)	56,863 (22)
Directed effort/acre	1.55 (22)
Total catch per hour	1.14 (39)
Catch/acre	2.35 (51)
Harvest per hour	0.45 (49)
Harvest/acre	0.86 (80)
Total harvest	31,735 (80)
Percent legal released	40.7

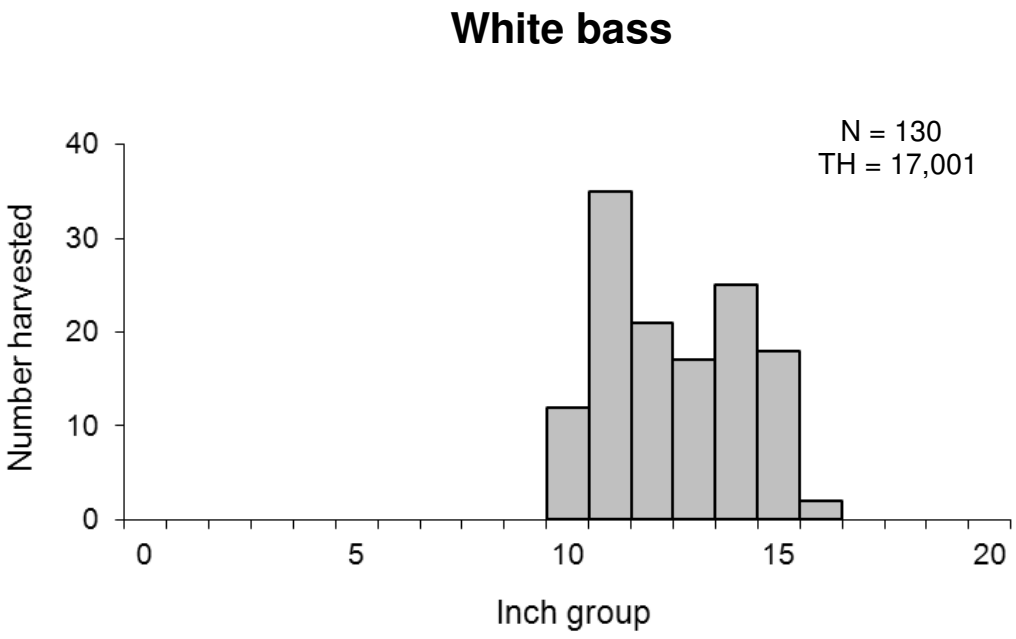


Figure 12. Length frequency of harvested white bass observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

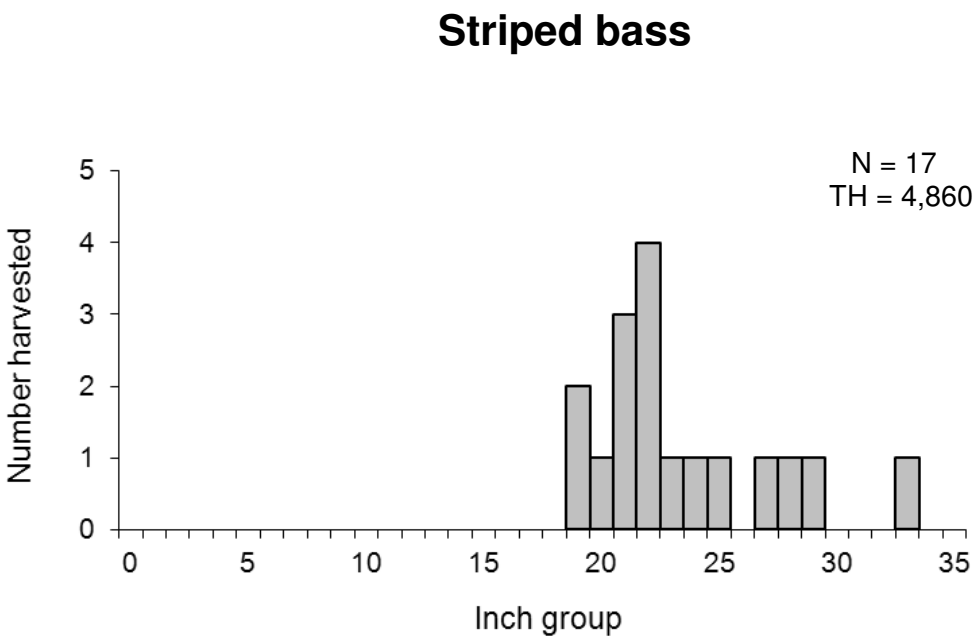


Figure 13. Length frequency of harvested striped bass observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested striped bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

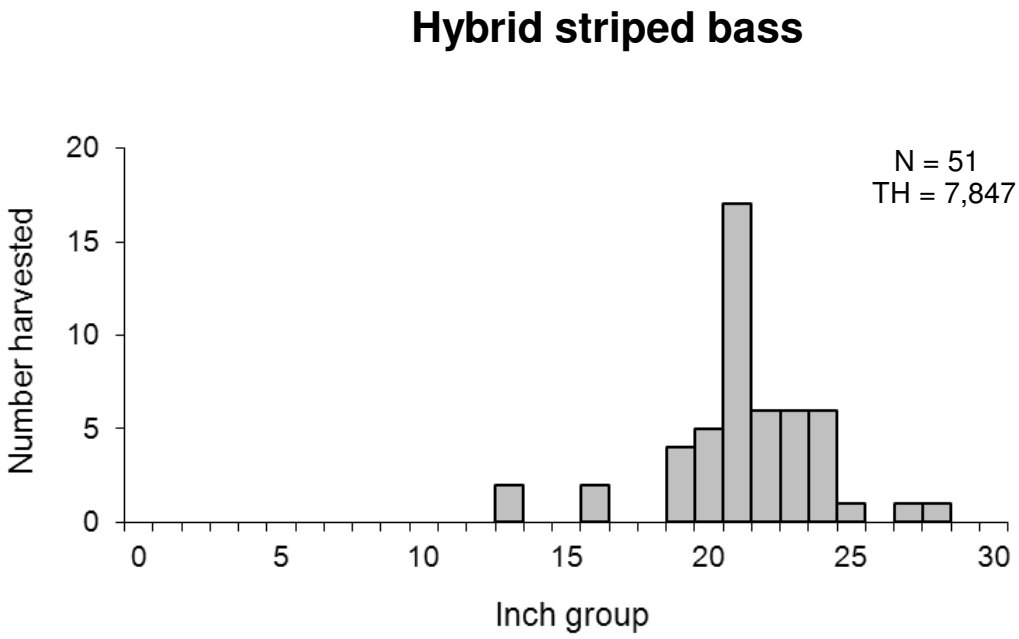
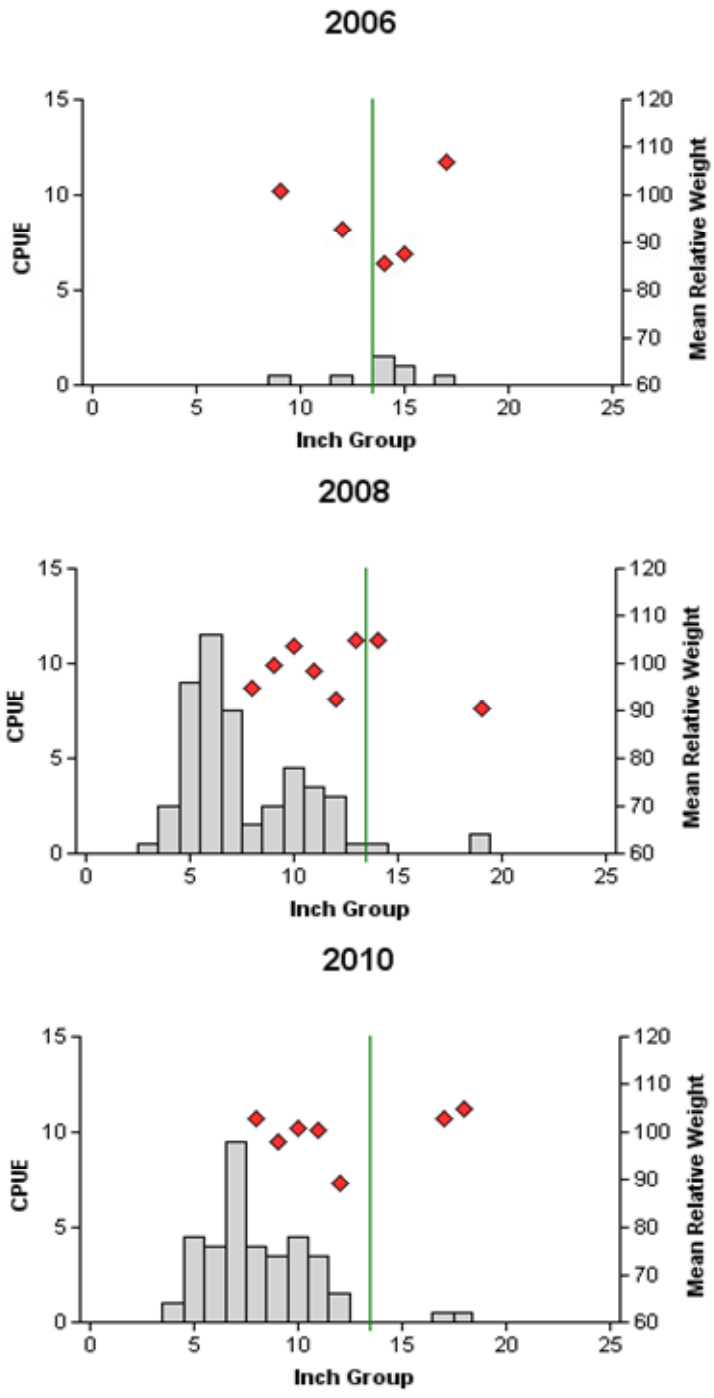


Figure 14. Length frequency of harvested hybrid striped bass (palmetto and sunshine bass combined) observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested hybrid striped bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth bass



Effort = 2.0
Total CPUE = 4.0 (35; 8)
Stock CPUE = 4.0 (35; 8)
PSD = 88 (12.1)
PSD-P = 38 (15.1)

Effort = 2.0
Total CPUE = 48.0 (21; 96)
Stock CPUE = 17.0 (24; 34)
PSD = 29 (6.5)
PSD-P = 6 (3.9)

Effort = 2.0
Total CPUE = 37.0 (21; 74)
Stock CPUE = 18.0 (28; 36)
PSD = 14 (3.9)
PSD-P = 6 (2.8)

Figure 15. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Tawakoni, Texas, 2006, 2008, and 2010. Vertical lines represent minimum length limit at time of survey.

Table 10. Creel survey statistics for rod-and-reel largemouth bass anglers at Lake Tawakoni from June 2008 through May 2009 where total catch per hour is for anglers targeting largemouth bass and total harvest is the estimated number of largemouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2008-2009
Directed effort (h)	19,731 (31)
Directed effort/acre	0.54 (31)
Total catch per hour	0.32 (35)
Catch/acre	0.10 (75)
Harvest per hour	0.01 (141)
Harvest/acre	0.01 (352)
Total harvest	7,503 (88)
Percent legal released	44.4

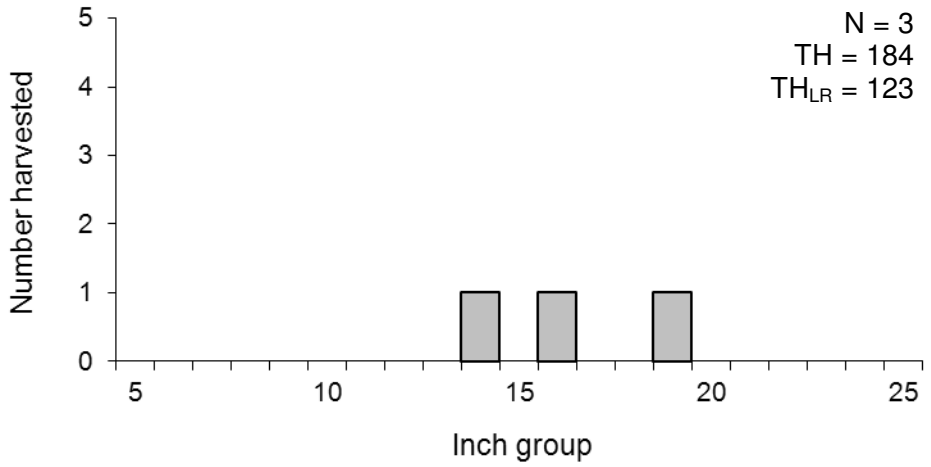


Figure 16. Length frequency of harvested largemouth bass observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, TH is the total estimated harvest for the creel period, and TH_{LR} is the total estimated number of fish retained by anglers participating in live-release tournaments.

Table 11. Results of genetic analysis of largemouth bass collected by fall electrofishing, Lake Tawakoni, Texas, 1987 - 2008. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between an FLMB and an NLMB. Since 2006 analyses have been conducted using DNA microsatellite analysis. Prior to that time starch gel electrophoresis was employed.

		Genotype					
Year	Sample size	FLMB	F1	Fx	NLMB	% FLMB alleles	% pure FLMB
1987	16	0	1	3	12	7.8	0.0
1991	25	0	0	2	23	2.0	0.0
1992	35	4	0	4	27	12.9	11.4
1993	35	5	1	1	28	23.6	14.3
1994	32	0	4	8	20	12.5	0.0
1995	35	1	3	0	31	7.1	2.9
1998	35	0	5	8	22	12.1	0.0
2000	18	4	4	6	4	50.0	22.2
2002	50	0	9	19	22	21.7	0.0
2008	30	0	0	24	6	20.0	0.0

Table 12. Creel survey statistics for rod-and-reel crappie (white and black crappie combined) anglers at Lake Tawakoni from June 2008 through May 2009 where total catch per hour is for anglers targeting crappie and total harvest is the estimated number of crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

	Year
Creel Survey Statistic	2008-2009
Directed effort (h)	4,246 (58)
Directed effort/acre	0.12 (58)
Total catch per hour	1.93 (28)
Catch/acre	0.21 (109)
Harvest per hour	1.80 (24)
Harvest/acre	0.20 (88)
Total harvest	7,503 (88)
Percent legal released	0

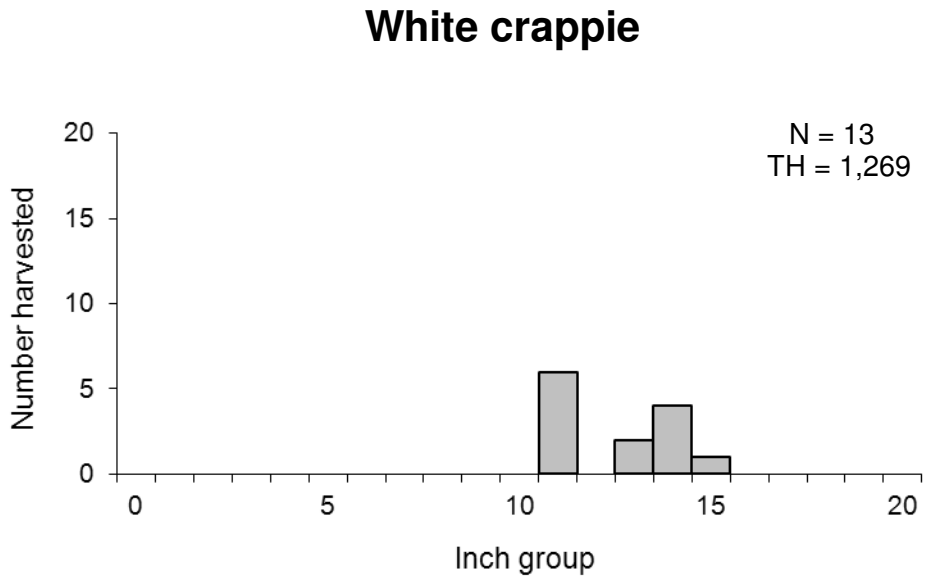


Figure 17. Length frequency of harvested white crappie observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested white crappie observed during creel surveys, and TH is the total estimated harvest for the creel period

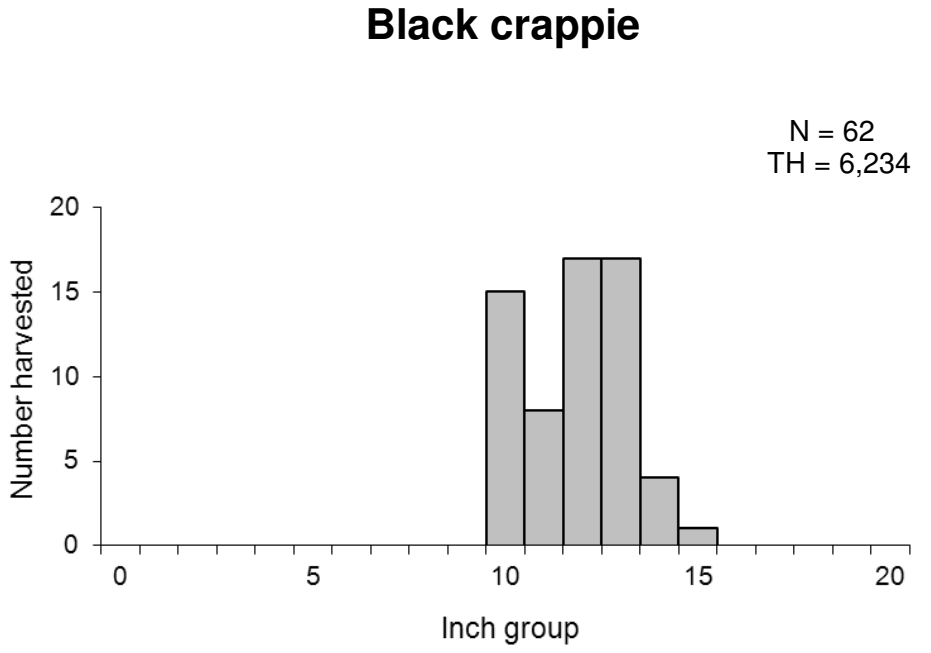


Figure 18. Length frequency of harvested black crappie observed during creel surveys at Lake Tawakoni, Texas, June 2008 through May 2009, all anglers combined. N is the number of harvested black crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Lake Tawakoni, Texas. Gill netting surveys are conducted in the spring, and electrofishing surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

Survey Year	Electrofishing	Gill netting	Vegetation survey	Habitat survey	Access survey	Report
2011-2012			A			
2012-2013		A	A			
2013-2014			A			
2014-2015	S	S	S	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from gill netting and electrofishing, Lake Tawakoni, Texas, 2010-2011.

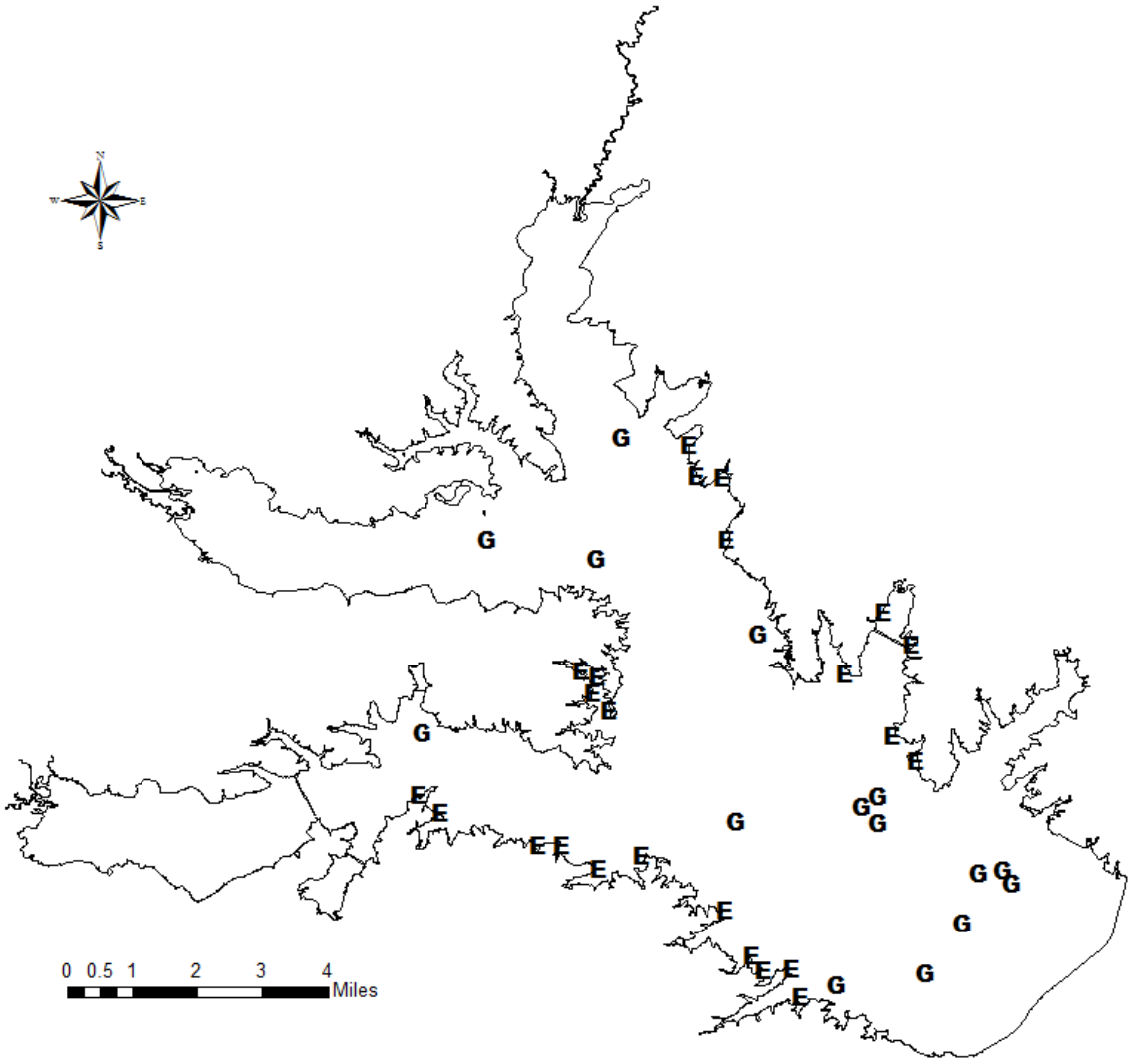
Species	Gill Netting		Electrofishing	
	N	CPUE	N	CPUE
Gizzard shad			374	187.0
Threadfin shad			164	82.0
Blue catfish	209	14.9		
Channel catfish	77	5.5		
White bass	27	1.9		
Striped bass	1	0.1		
Hybrid striped bass	12	0.9		
Green sunfish			1	0.5
Bluegill			149	74.5
Longear sunfish			88	44.0
Redear sunfish			54	27.0
Largemouth bass			74	37.0

APPENDIX B

Water body records, all tackle category, for Lake Tawakoni as of 6/14/2011.

Species	Weight (lbs)	Length (inches)	Date certified	Gear
Bass, Largemouth	13.33	26.00	02/14/2000	Rod & reel
Bass, Palmetto	15.25	28.00	5/16/1988	Rod & reel
Bass, Striped	22.50	35.75	6/7/2004	Rod & reel
Bass, White	4.84	23.00	9/12/2009	Rod & reel
Bass, White x Yellow	3.50	18.00	7/15/1989	Rod & reel
Bass, Yellow	1.30	13.25	11/29/2010	Rod & reel
Bluegill	0.50	8.50	8/27/2010	Rod & reel
Bowfin	7.22	26.50	3/4/2009	Rod & reel
Buffalo, Smallmouth	52.75	41.00	5/6/1995	Rod & reel
Carp, Common	19.27	35.00	9/12/2010	Bow & arrow
Catfish, Blue	86.60	49.00	4/29/2009	Trotline
Catfish, Channel	31.00	42.00	10/02/2001	Trotline
Catfish, Flathead	110.50	60.50	6/5//1998	Trotline
Crappie, Black	2.82	16.00	3/6/2009	Rod & reel
Crappie, White	3.33	17.75	4/6/1998	Rod & reel
Drum, Freshwater	3.25	19.75	6/20/2009	Rod & reel
Gar, Longnose	8.38	38.00	8/2/2008	Bow & arrow
Gar, Spotted	4.13	28.75	6/20/2009	Rod & reel
Goldfish	9.22	24.50	8/4/2004	Bow & arrow
Sunfish, Green	0.30	8.00	6/28/2009	Rod & reel
Sunfish, Longear	0.19	5.75	8/2/2003	Fly rod
Sunfish, Redear	0.18	6.65	09/14/1999	Fly rod

APPENDIX C



Location of fall electrofishing (E) and spring gill netting sites (G), Lake Tawakoni, Texas, 2010 - 2011.

Appendix D

Angler responses to questions regarding preferences about catfish angling at Lake Tawakoni, Texas, September 2008 through May 2009.

		Targeted species			
		Catfish rod & reel	Catfish passive gear	Other species	Number of responses
1	**Are you satisfied with the current catfish regulations on this lake?**				
1	Very dissatisfied	2 (3%)	-	-	2
2	Dissatisfied	-	-	-	-
3	Neutral	3 (5%)	-	-	3
4	Satisfied	8 (13%)	-	6 (10%)	14
5	Very satisfied	24 (39%)	2 (3%)	16 (26%)	42
					61
2	**For a successful fishing trip, what is more important to you?**				
1	Numbers of legal-sized fish caught	15 (25%)	-	11 (18%)	26
2	A few large/trophy fish	10 (16%)	1 (2%)	4 (7%)	15
3	No preference	12 (20%)	1 (2%)	7 (11%)	20
					61
3	**If you catch a large/trophy catfish what would you do with it?**				
1	Always keep it	8 (13%)	1 (2%)	6 (10%)	15
2	Sometimes keep it	8 (13%)	1 (2%)	6 (10%)	15
3	Always release it	20 (33%)	-	10 (17%)	30
					60
4	**Do you think that protecting large/trophy catfish would improve the fishery of this lake?**				
1	Yes	28 (47%)	-	10 (17%)	38
2	No	8 (13%)	2 (3%)	12 (20%)	22
					60